

# Improvement on Designing a Biomedical Apparatus for Patient with Broken Arm

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## Abstract

Chronic joint conditions, which affect millions globally, significantly impact individuals' quality of life and daily functionality. Continuous Passive Motion (CPM) devices have emerged as a crucial tool in managing these conditions in recent years. CPM devices provide the convenience of undergoing rehabilitation at home, enhancing the patient's comfort. They aid in improving joint mobility, alleviating pain, and minimizing thrombosis risks. Furthermore, these devices contribute to reducing hospitalization duration, facilitating quicker recovery at home.

## Continuous Passive Motion Machine



The type of exercise can be selected and terminated from the control panel. The stepper motor, controlled by the Arduino, ensures precise, gradual movements. This approach allows for a customizable and user-friendly experience, catering to the specific needs and comfort of the user.

**Motorized Device:** The CPM machine is a motorized device that passively moves the joint through a pre set range of motion. The pulses are generated by an electrical motor and are transmitted to the joint through a mechanical arm.

**Adjustable Controls:** The machine has controls that allow healthcare providers or patients to adjust the desired range of motion and speed of movement.

**Joint Movement:** The machine moves the joint without the patient having to move their muscles. This helps counteract the negative effects of prolonged immobilization.

**Recovery Aid:** The CPM machine is used after surgery to reduce joint stiffness and improve range of motion. They're sometimes used after knee replacement surgery but can also be used after elbow, hip, or shoulder surgery.

**Usage:** The patient places their surgical arm into the machine and secures it using the straps. The machine then gently moves the arm, flexing and extending the joint.

## The health effects of CPM machine Using a CPM Machine

**Joint Movement:** The CPM machine passively moves a joint through a predetermined range of motion. This helps counteract the negative effects of prolonged immobility.

**Pain Reduction:** The CPM machine can reduce pain and further decrease pain by reducing swelling.

**Blood Flow:** The CPM machine increases blood flow in your arm or leg.

**Tissue Strengthening:** The use of the CPM machine can strengthen your tendons and ligaments, which are tissues that connect your muscles and bones.

**Recovery:** The CPM machine helps reduce joint stiffness and improve the range of motion. However, the benefit of using the CPM machine is controversial. Some studies have not shown an improvement in the range of motion in patients used post-operatively.

**Risks:** There are some risks to CPM therapy, and therefore it is important to be directed by a healthcare provider.

### Before Therapy:

Your doctors will tell you before if you need CPM therapy.

You might start CPM therapy right after surgery or the next day. You can use the machine all the time in the hospital, except when you are doing other exercises or going to the bathroom.

When you go home, you might get a CPM machine to use at home. You might use it all day or just a few hours. You might do this for many weeks.

### During Therapy:

CPM machines, designed for various joints, operate based on the same principles. These devices are tailored to fit the specific joint being treated. Before you're secured into the machine, your healthcare provider or physical therapist will adjust the machine's speed and range of motion.

Once you're secured, the machine is activated and it repetitively moves the joint, causing it to bend and straighten within a controlled movement plane.

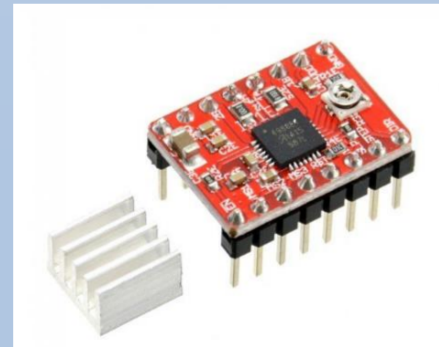
CPM machines for the knee or hip are portable devices that are positioned on a bed and move the joint while you're lying down.

During the procedure, you might experience a bit of discomfort, but you shouldn't feel any severe pain. If you do, inform your provider so they can adjust the machine's speed, range of motion, or position.

### After Therapy:

After the procedure, you might experience some discomfort, and if necessary, you could be provided with pain relief medication. If you require a CPM machine at home, you'll receive guidance on its usage. This includes the duration of use each day and whether you need to adjust the settings periodically. If you're uncertain or if you feel pain, it's important to inform your healthcare provider. CPM is frequently combined with other forms of physical therapy. Your progress will be closely monitored by your physical therapist, who will then decide on the most appropriate exercises or treatments for you based on your improvement.

## Main Components



Nema 17 Stepper Motor

A4988 Stepper Motor Driver Board

OEM 128X64 0.96 Inch LED Screen

Arduino Uno

12V 3Amps Power Supply

3D Materials

## Conclusion

This machine initiates slow, controlled movements to aid in the recovery of a broken arm. It allows users to select and terminate exercises via a control panel, providing a cost-effective and convenient home-based physiotherapy solution. This represents a significant advancement in the field of home-based physiotherapy.

## Referances

Controlling NEMA 17 Stepper Motor with Arduino and A4988 Stepper Driver Module (circuitdigest.com)

CPM Machine After Knee Replacement: Uses and Benefits (verywellhealth.com)

<https://www.medcomgroup.com/understanding-cpm-machines>

<https://www.healthline.com/health/cpm-machine#uses>

<https://www.verywellhealth.com/cpm-continuous-passive-motion-2549555>